ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

TYPE VE-9T RELAY – 8230326, 8235328, 8245903, 8267987, AND 8411512

DESCRIPTION

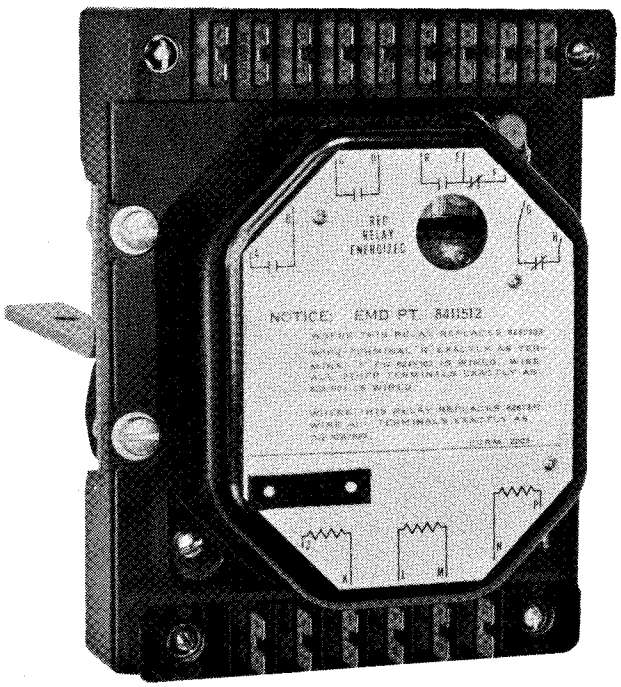
The type VE-9T relay, Figs. 1 and 2, is a direct current, through cable type of relay used as the major component in all locomotive voltage-current (E-I) transition circuits. The relay is also used, in some applications, to prevent overload of the traction motors or to detect wheel slip.

NOTE: When relay 8245903 is used as a replacement for 8235328, a No. 14 jumper wire must be connected between coil terminals L and K.

The relay combines heavy duty construction with performance characteristics to provide maximum dependable service. It offers substantial improvement over previous transition relays as it is unaffected by the magnetic fields of surrounding cables or coils.

When used as a transition or a wheel slip relay, it operates on main generator voltage and is biased by main generator current. When used as a current limit relay, it operates on main generator current and is biased by auxiliary generator voltage.

Two L-shaped brackets on the relay are used for attaching the relay to a bus bar which passes between the coils.



16244

Fig. 1 – VE-9T Relay
3/4 Front View – 8411512

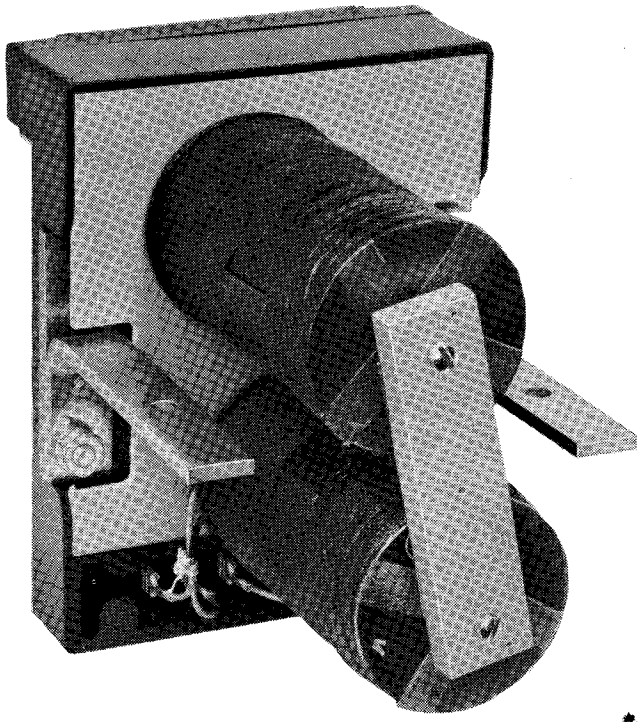


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Fig. 2 – VE-9T Relay
3/4 Rear View – 8411512

*This bulletin is revised and supersedes previous issues of this number.

The relay contacts are silver alloy and are rated at 5 amperes. Silver alloy contacts do not require cleaning or dressing. Even though contacts may become blackened and slightly pitted, satisfactory operation will be obtained as silver oxide is an excellent conductor.

The material of the contact driver which was formerly nylon, is now made of glass polyester to improve the performance of the relay. All moving parts of the relay, Fig. 3, are protected by a dustproof box-type cover.

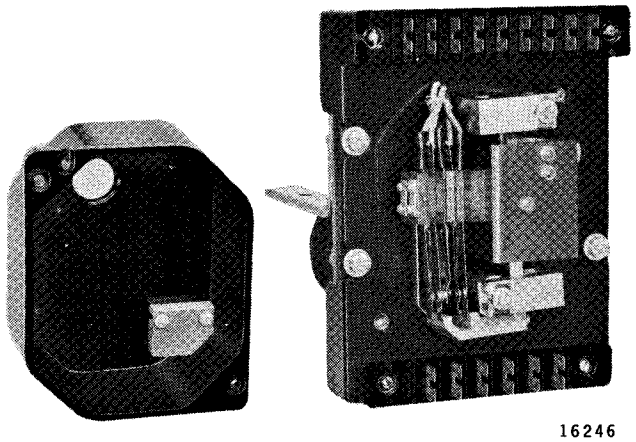


Fig. 3 – Front Of Relay – Cover Removed

Originally, relays 8230326 and 8235328 did not have a permanent magnet blowout in the relay cover. Later a permanent magnet blowout, Fig. 3, was added to the cover for longer contact life. This cover is directly interchangeable with the former cover. The contacts next to the cover are affected by the blowout. Polarity must be observed on these contacts to obtain full benefit from the magnetic blowout. See Maintenance Data.

Internal electrical connections are made on 1/4" terminal studs with washers and standard hexagon nuts. Terminal identification letters are stamped on front of the relay and the contact terminals are located across the top when relay is mounted with nameplate up, and in the reverse location when relay is inverted.

An L-shaped Alnico permanent magnet is mounted on top of each coil pole, see Fig. 4, to polarize the relay so that it will pick up in only one direction. On bus current alone, dependent on direction of current flow, the relay will pick up at 750 ± 30 amperes and drop out at 525 ± 30 amperes. It will not pick up on reverse current less than 6000 amperes. Refer to Figs. 5 and 6 for bus current direction.

OPERATION

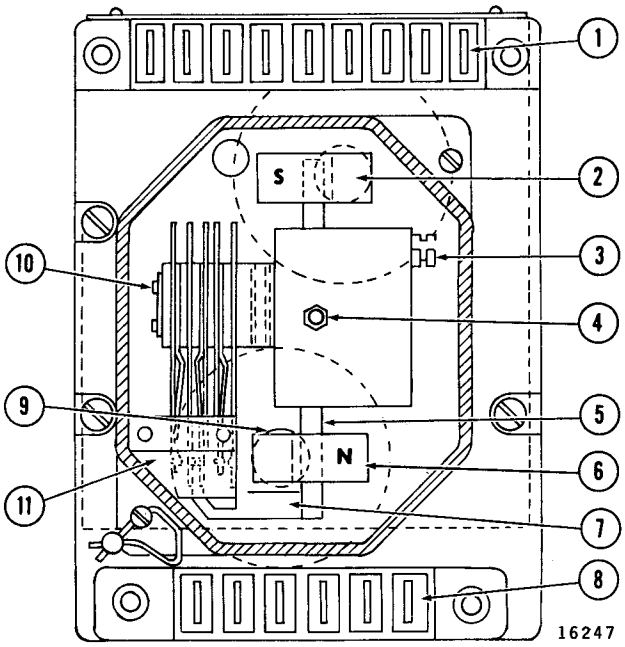
Refer to Fig. 4 for component location.

The armature (5) is positioned so that the coil poles (9) are on opposite sides and ends of the armature. When voltage is applied to the coils of the relay, a magnetic attraction is established between the coil poles and the ends of the armature. The magnetic flux produced by the voltage coils is opposed by that established by the current in the bus bar.

When the voltage-to-current ratio becomes high enough, with respect to the set value of the relay, the armature will pick up. The movement of the armature in a clockwise direction towards the coil poles causes the insulated contactor driver (7) to push against the contact stack heel spring. This action opens the normally closed contacts and closes the normally open contacts.

The armature is now closer to the coil poles and farther from the Alnico permanent magnets (2 and 6). Therefore, the ratio of voltage-to-current acting upon the relay must drop substantially below the pickup ratio before the armature will move counterclockwise and allow the contacts to return to their normal position.

For specific information relating to E-I relay operation, refer to locomotive wiring diagrams.



1. Contact Terminals
2. Alnico Magnet
3. Hold Down Springs
4. Armature Pivot
5. Armature
6. Alnico Magnet
7. Insulated Contact Driver
8. Coil Terminals
9. Coil Pole
10. Contact Stack
11. Magnetic Blowout

Fig. 4 – VE-9T Relay – Cross Section

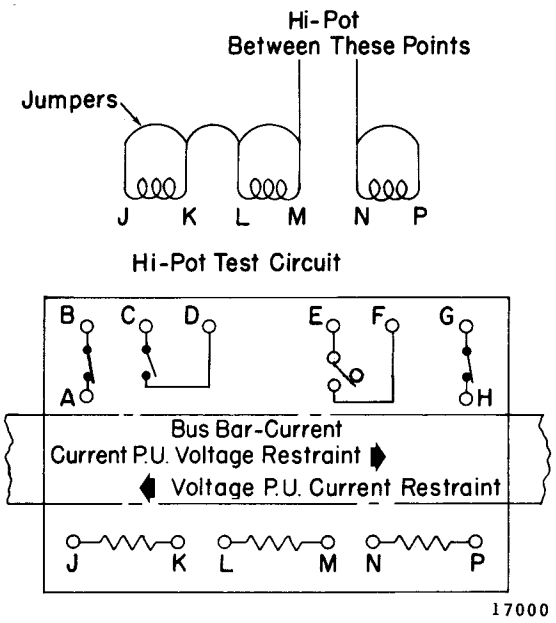


Fig. 5 – Bus Bar Current Flow – All Relays Except 8411512

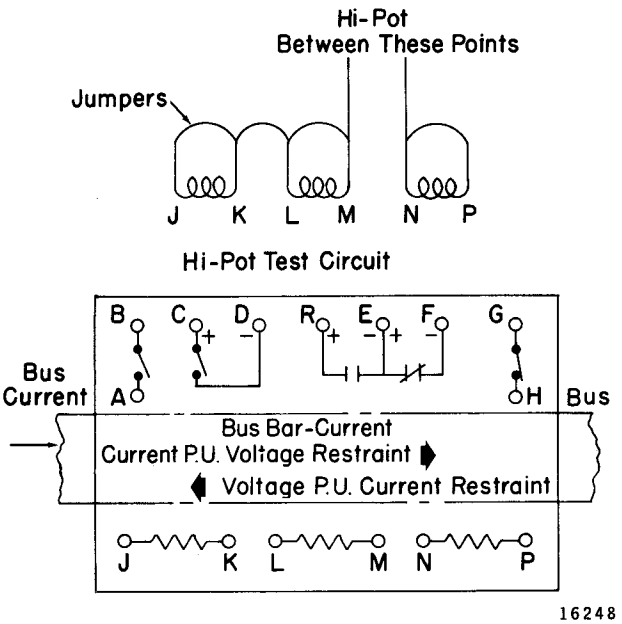


Fig. 6 – Bus Bar Current Flow – 8411512

MAINTENANCE

The relay has been designed to withstand rugged service and to require a minimum of maintenance or attention. The use of silver alloy contacts, the dust proof cover with the magnetic blowout and the glass polyester contact driver contribute to trouble free performance and long service life.

The relay is manufactured to close tolerances with precise and fine internal adjustments. Therefore, it is suggested that maintenance be limited to the following procedure to qualify the relay for continued service.

TEST PROCEDURE

Perform the tests at intervals specified in the applicable Scheduled Maintenance Program without removing the relay and with the unit shut down and isolated.

1. Check the pickup and dropout of the relay, on voltage only, through the J-K coil.
2. Connect test circuit lead from milliammeter to terminal J and the lead from the adjustable rheostat to terminal K. See Fig. 7.
3. A test light may be connected across relay terminals A and B to observe relay pickup and dropout.
4. Gradually increase coil current, check relay pickup by adjusting the rheostat. Refer to Maintenance Data for applicable pickup value.
5. Reduce coil current and check the relay dropout. Refer to Maintenance Data for applicable dropout value.
6. Check the pickup and dropout of the relay, on voltage only, through L-M coil.
7. Connect test circuit lead from milliammeter to terminal L and the lead from the adjustable rheostat to terminal M.
8. A test light may be used as in Step 3 above.
9. Repeat procedures in Steps 4 and 5 above.
10. Check the pickup and dropout of the relay, on voltage only, through the N-P coil.

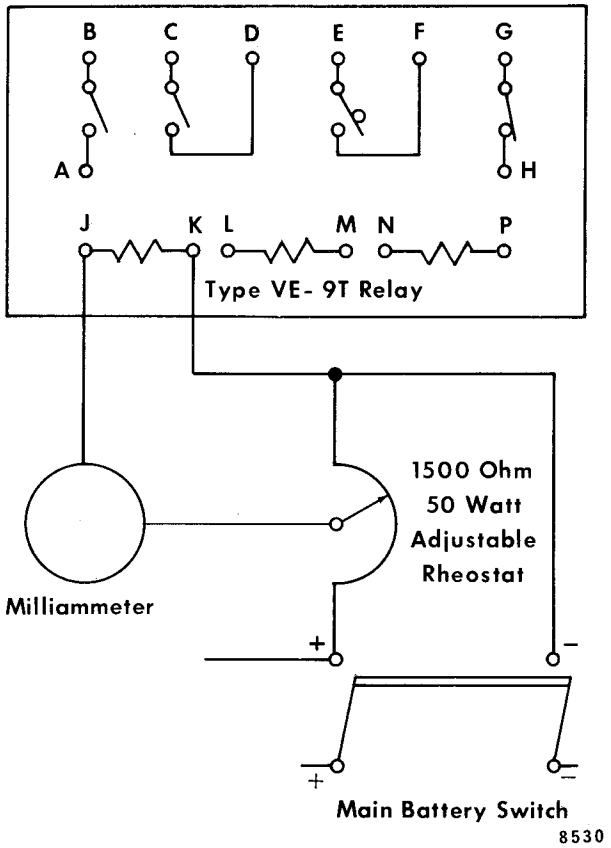


Fig. 7 — Pickup And Dropout Test Diagram

11. Connect test circuit lead from milliammeter to terminal N and the lead from the adjustable rheostat to terminal P.

12. A test light may be used as in Step 3 above.

13. Repeat procedures in Steps 4 and 5 above.

If the relay voltage coil tests are satisfactorily within the limits specified in the Maintenance Data, it will also be satisfactory for pickup and dropout on bus current alone and need not be checked.

REMOVING RELAY

If the relay does not meet the specified pickup and dropout values it should be replaced and the defective relay returned to Electro-Motive on a Rebuild and Return basis. Servicing relay internal adjustments requires special equipment.

Previous relays had to be removed or replaced by sliding the relay off or on to the bus bar to avoid loss of the non-magnetic shims by removing the bar from the back of the coils. Present relays have the non-magnetic shims pinned to the bar eliminating the danger of loss.

CAUTION: Do not use non-magnetic shims from one relay to another as this will change the adjustment of the relay.

On the 40 series locomotives, the relay is assembled to the bus bar by removing the bar from the back of the two coils. The relay is placed so that the bus bar is between the two coils. The bar from the coils is inserted through the hole in the bus bar and fastened to the back of the coils. The relay brackets are fastened to the bus bar as before.

Electro-Motive has a relay tester 8246474 which can be used in place of the milliammeter and rheostat when testing coil voltage. The leads are long enough to permit checking the VE-9T relay, ground relay, and wheel slip relays on most EMD locomotives.

REPLACING RELAY

When replacing relay 8267987 with relay 8411512 the interlocks are identical. When replacing relay 8245903 the interlock arrangement is slightly different. It should be noted that the E-F interlock on relay 8245903 now becomes the E-R interlock on relay 8411512.

The "E" terminal is common to the E-R and E-F interlocks. When replacing relay 8245903 with the relay 8411512 on an SD45 locomotive, the following instructions should be observed:

1. Remove wires on "F" terminal of 8245903 and connect them to "R" terminal of 8411512.
2. Remove all other wires from 8245903 and connect to the same letter terminal on 8411512.

MAINTENANCE DATA

Part Number	8230326	8235328	8245903	8267987	8411512
Contacts					
Arrangement	3 N.O. - 1 N.C.	3 N.O. - 1 N.C.	3 N.O. - 1 N.C.	2 N.O. - 2 N.C.	3 N.O. - 2 N.C.
Rating	5 amperes	5 amperes	5 amperes	5 amperes	5 amperes
J-K Coil					
Resistance	440 ±10% Ohms @ 20 C.	460 ±10% Ohms @ 20 C.	255 ±10% Ohms @ 20 C.	255 ±10% Ohms @ 20 C.	255 ±10% Ohms @ 20 C.
Equivalent Bus Turns	14,500	18,800	11,350	11,350	11,350
Continuous Ampere Rating	0.240	0.250	0.300	0.300	0.300
L-M Coil					
Resistance	50 ±10% Ohms @ 20 C.	47 ±10% Ohms @ 20 C.	205 ±10% Ohms @ 20 C.	205 ±10% Ohms @ 20 C.	205 ±10% Ohms @ 20 C.
Equivalent Bus Turns	2,800	3,100	7,500	7,500	7,500
Continuous Ampere Rating	0.240	0.250	0.300	0.300	0.300
N-P Coil					
Resistance	------	------	47 ±10% Ohms @ 20 C.	47 ±10% Ohms @ 20 C.	47 ±10% Ohms @ 20 C.
Equivalent Bus Turns	------	------	3,100	3,100	3,100
Continuous Ampere Rating	------	------	0.300	0.300	0.300
J-K and L-M coils in series have approx. equivalent bus turns	17,300	21,900	18,850	18,850	18,850
Relay Pickup					
J-K Coil Only	52 ±3 MA.	40 ±3 MA.	66 ±6 MA.	66 ±6 MA.	66 ±6 MA.
L-M Coil Only	------	------	100 ±10 MA.	100 ±10 MA.	100 ±10 MA.
N-P Coil Only	------	------	240 ±20 MA.	240 ±20 MA.	240 ±20 MA.
Bus Current Only	750 ±30 amps.	750 ± 30 amps.	750 ±30 amps.	750 ±30 amps.	750 ±30 amps.
J-K and L-M Coils in Series	44 ±3 MA.	34 ±3 MA.	------	------	----------
Relay Dropout					
J-K Coil Only	36 ±3 MA.	28 ±3 MA.	45 ±6 MA.	45 ±6 MA.	45 ±6 MA.
L-M Coil Only	------	------	69 ±10 MA.	69 ±10 MA.	69 ±10 MA.
N-P Coil Only	------	------	168 ±20 MA.	168 ±20 MA.	168 ±20 MA.
Bus Current Only	525 ±30 amps.	525 ±30 amps.	525 ±30 amps.	525 ±30 amps.	525 ±30 amps.
J-K and L-M Coils in Series	31 ± 3 MA.	24 ±3 MA.	------	------	------
Hy-Pot Test					
Bus to Coil and Contacts	2400 volts R.M.S. 60 cycles	2400 volts R.M.S. 60 cycles	2800 volts R.M.S. 60 cycles	2800 volts R.M.S. 60 cycles	2800 volts R.M.S. 60 cycles
Coils to Contacts	Ditto	Ditto	Ditto	Ditto	Ditto
Contacts to Contacts	Ditto	Ditto	Ditto	Ditto	Ditto
Coil to Coil	------	------	Ditto	Ditto	Ditto
Magnetic Blowout					
Positive Contacts	C and F	C and F	C and F	C and F	C and F

Litho in U.S.A.